

Nutraceutical Compound Concentrations of Muscadine (*Vitis rotundifolia* Michx.) Grapes



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Abstract

Consumption of fresh fruits and vegetables has been linked both anecdotally and clinically to the prevention or alleviation of chronic diseases, and provides essential nourishment to mankind. The muscadine grape, a fruit indigenous to the southeastern U.S., contains several phenolic compounds that act as antioxidants and also other compounds, such as resveratrol, that can perform as a chemopreventative. The concentrations of these compounds present in the muscadine grape equal or exceed that known for other small fruit. Fruit of selected muscadine grape genotypes, including breeding lines and cultivars, were evaluated over a 2-year period to assess the existing genetic base for these nutraceutical compounds. Results demonstrated that concentrations of anthocyanins, total phenolics, ellagic acid, and resveratrol differ significantly among cultivars and breeding lines. These results suggest a possibility to breed for increased concentrations of the health-promoting compounds in muscadine grapes.

Objective

The objective of this study is to determine measure variations between breeding lines of cultivated muscadine grapes. If there are differences among breeding lines, plant geneticist can breed towards developing cultivars with higher nutraceutical value.



Introduction

Muscadine grapes (*Vitis rotundifolia* Michx) are native to the warm humid climates of the southeastern United States. Muscadines grow wild from Delaware to the Gulf of Mexico and as far west as Missouri to Texas.

Phytochemical composition of whole muscadine grapes differ from *Vitis vinifera* in that muscadines have a higher total phenolic content distinguished by high ellagic, gallic, and flavonoid concentrations. Muscadines have a higher total phenolic content distinguished by high ellagic, gallic, and flavonoid glycoside concentrations. Another unique feature of the anthocyanin chemistry observed in muscadines shows 3,5-diglucosides of delphinidin, cyanidin, petunidin, peonidin, and malvidin in non-acylated forms. Resveratrol (3,5,4'-trihydroxy-trans-stilbene) is a natural compound found in large quantities in grapes and red wine. Yet with 70-90% of the total phenolics of the muscadine in the skin and seed, these components are usually discarded as waste.

Materials and Methods.

Plant material

Four named muscadine cultivars Carlos (bronze), Magnolia (bronze), Albermarle (purple), and Noble (purple) were evaluated along with 8 selections from the breeding program (one bronze, and 7 purple). Fruit were harvested at full ripe stage from the USDA-ARS vineyard in McNeil, MS. The plants were mature 11-year-old plants managed using standard cultural procedures. Muscadines were frozen after harvest and held for analysis. Fruit were thawed and juiced for analysis. Total anthocyanin and total soluble phenolics were extracted from juice samples using acetone/methanol/formic acid solution.

Total Soluble Phenolics

Determination of total phenolics in samples were analyzed by the Folin-Ciocalteu colorimetric method Singleton et al. (1999) on a sub-sample of 50 grams of fresh fruit using gallic acid as a standard.

Anthocyanin

The total anthocyanin content of the fruit extract was determined using a modified pH differential method. A UV-visible spectrophotometer was used to measure absorbance at 510 and 700 nm in buffers at pH 1.0 and 4.5.

Ellagic Acid

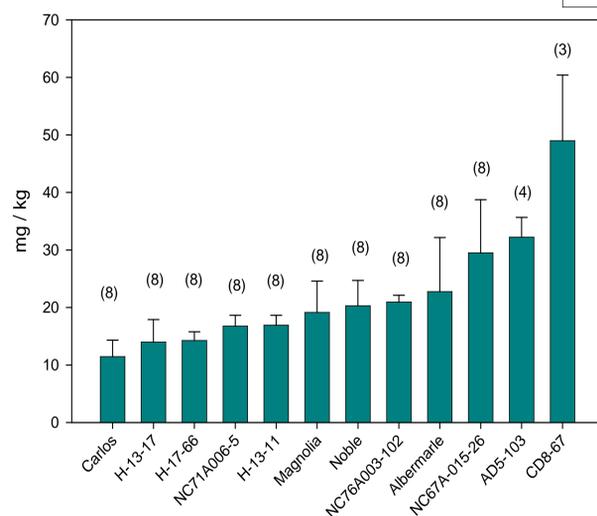
The ellagic acid was isolated with pure methanol extraction from pureed whole muscadines and subjected to liquid chromatographic UV-Vis detection analysis operated at 255 nm.

Resveratrol

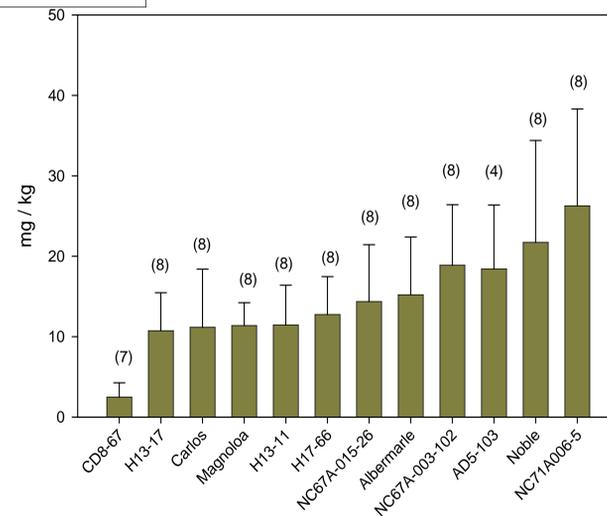
Resveratrol was also extracted with methanol from pureed muscadines and subjected to HPLC analysis detected with a UV-Vis at 310 nm.

Results

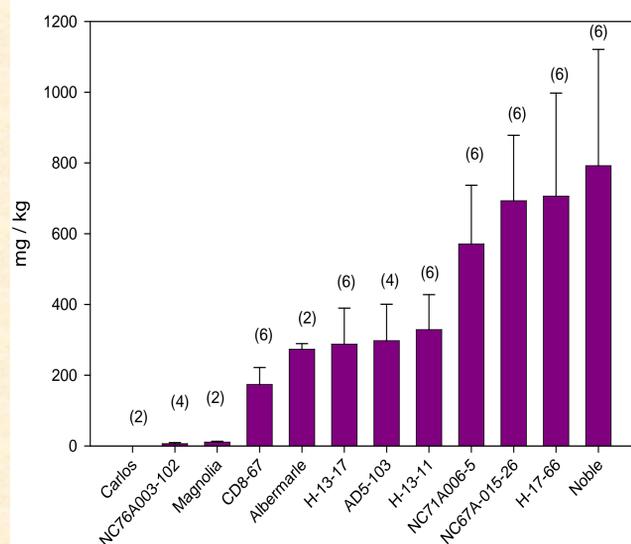
Ellagic Acid Content of Muscadine Grapes



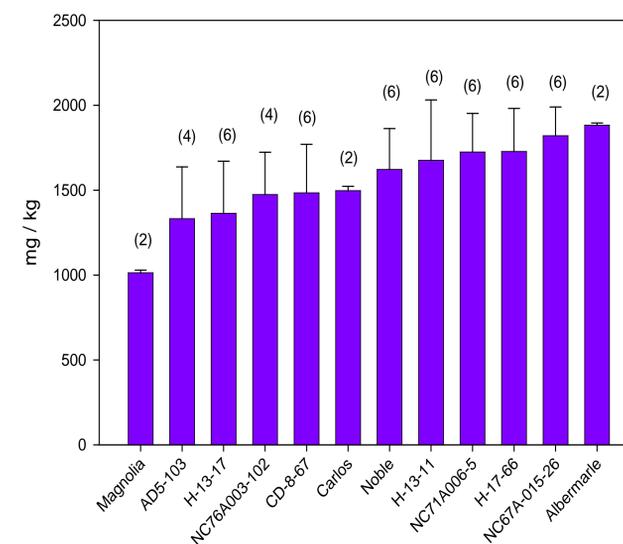
Resveratrol Content of Muscadine Grapes



Anthocyanin Content of Muscadine Grapes



Total Phenolics Content of Muscadine Grapes



Results and Discussion

Ellagic acid, which is not commonly found in other grape species (Olien, 1990), content range from 11.46 mg/kg in Carlos to 49.00 mg/kg found in CD8-67. This is a large range in ellagic acid content.

The muscadine selection CD8-67 exhibits the least amount of resveratrol content with 2.48 mg/kg with the highest concentration being found in NC71A006-5, another selection.

Total phenolics, which correlates highly with the antioxidant activity (Wang and Jiao, 2000), is found to be high in all varieties with the exception of Magnolia, a bronze berry. Yet the other bronze fruit of Carlos and NC76A0003-102 where equivalent to the purple fruit.

Anthocyanin content, which is also correlated highly with antioxidant activity (Wang and Jiao, 2000), shows a definite distinction between bronze and dark fruit. The fruit of the bronze varieties Magnolia, Carlos, NC76A0003-102 show significantly less anthocyanin. This would be expected since the anthocyanin content develops the color of the fruit.

With ranges of phytonutrient content in both cultivated varieties as well as breeding lines, it is possible to breed for increased concentrations of the health-promoting compounds in muscadine grapes.